Connecting Structure for a Striking Plate of a Golf Club Head

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a connecting structure for connecting a striking plate of a golf club head. In particular, the present invention relates to a connecting structure for connecting a striking plate to a golf club head body.

2. Description of Related Art

Figs. 1 and 2 of the drawings illustrate a typical golf club head including a golf club head body 10 and a striking plate 20. The golf club head body 10 includes a recession 11, with a shoulder 12 being formed on an inner peripheral edge of the recession 11 and with a flange 13 being formed on an outer peripheral edge of the recession 11. The striking plate 20 includes a stepped portion 21 on a periphery thereof. When connecting the striking plate 20 to the golf club head body 10, the striking plate 20 is firstly inserted into the recession 11, and a pressing block (not shown) is used to press the flange 13, causing the flange 13 to deform and thus engage with the stepped portion 21, thereby finishing connection between the striking plate 20 and the golf club head body 10.

In manufacture, the golf club head body 10 is generally made of stainless steel, carbon steel, or alloy steel and the striking plate 20 is generally made of titanium alloy or stainless steel while considering the cost, striking

function, and the overall structural strength. The Young's modulus of the material of the striking plate 20 is smaller than that of the material of the golf club head body 10; namely, the striking plate 20 has a greater coefficient of restitution (COR). Thus, the striking plate 20 deforms while striking a golf ball (not shown), thereby reducing the deformation of the golf ball. As a result, loss of the striking energy is reduced and the golf ball flies farther, as the amount of the striking stress absorbed by the damping effect is reduced. However, when the golf club head body 10 is made of a material having a greater Young's modulus (e.g., stainless steel or carbon steel having a Young's modulus of 3×10^7 psi) under the consideration of overall structural strength, the golf club head body 10 having a low deformability and a high damping coefficient absorbs more striking stress, which adversely affects the deformability and striking effect of the striking plat 20. Further, the absorbed striking stress would cause vibrations of the golf club head body 10, which vibrations would be transmitted to the golf club and the handle of the golf club. The gripping comfort and the structural integrity of the golf club are thus adversely affected.

OBJECTS OF THE INVENTION

An object of the present invention is to provide a connecting structure for a striking plate of a golf club head that reduces the amount of the striking stress of the striking plate absorbed by the golf club head body is reduced, thereby assuring high deformability of the striking plate. The striking effect of

the golf club is thus improved.

Another object of the present invention is to provide a connecting structure for a striking plate of a golf club head that reduces an amount of the striking stress of the striking plate absorbed by the golf club head body. Vibrations transmitted to the handle of the golf club are reduced, and the gripping comfort is thus improved.

SUMMARY OF THE INVENTION

To achieve the aforementioned objects, the present invention provides a golf club head including a golf club head body, a ring, and a striking plate. The golf club head body includes a recession in a side thereof, the recession including a shoulder on an inner peripheral edge thereof. The ring is mounted on the shoulder of the golf club head body. The striking plate is mounted in the recession of the golf club head body and securely engaged with the ring, with the ring supporting a rear side of the striking plate.

The striking plate and the golf club head body have a relatively small contact area therebetween to thereby reduce an amount of the striking stress of the striking plate absorbed by the golf club head body, thereby assuring high deformability of the striking plate.

The ring is made of a material having a Young's modulus smaller than 3×10^7 psi. Preferably, the material of the ring is titanium, brass, bronze, aluminum, magnesium, or wood.

In an embodiment of the invention, the recession of the golf club head

body further includes a flange on an outer peripheral edge thereof, and the striking plate includes a stepped portion. The flange is pressed to form a filling material for engaging with the stepped portion of the striking plate, thereby engaging the striking plate with the golf club head body.

In another embodiment of the invention, the shoulder of the golf club head includes an annular groove for securely receiving the ring. The annular groove includes a plurality of notches in at least one of two opposed annularly extending corner portions thereof. The notches receive deformed portion of the ring during a pressing procedure, thereby reducing a contact area between the striking plate and the shoulder of the golf club head body.

In a further embodiment of the invention, the striking plate is supported by the ring, forming a gap between the shoulder of the golf club head and the striking plate. A filling layer fills in the gap. Preferably, the filling layer is formed as a result of hardening of a photocuring resin. The photocuring resin is a resin that hardens under radiation with visible lights or ultraviolet rays.

In still another embodiment of the invention, the ring includes a base portion and an annular protrusion on a side of the base. The striking plate is mounted inside the annular protrusion and supported by the base portion of the ring when the striking plate and the ring are engaged in the golf club head body.

The striking plate is made of a material having a Young's modulus

smaller than 3 x 10^7 psi. Preferably, the striking plate is made of titanium alloy, stainless steel, or special steel. The golf club head body is made of a material having a Young's modulus greater than 3 x 10^7 psi. Preferably, the golf club head body is made of stainless steel, carbon steel, alloy steel, or Fe-Mn-Al alloy.

Other objects, advantages and novel features of this invention will become more apparent from the following detailed description when taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is an exploded sectional view of a conventional golf club head;

Fig. 2 is a sectional view of the conventional golf club head in Fig. 1;

Fig. 3 is an exploded sectional view illustrating a golf club head in accordance with the present invention before processing;

Fig. 4 is a sectional view of the golf club head in Fig. 3;

Fig. 5 is a sectional view of the golf club head in accordance with the present invention after processing;

Fig. 6 is an enlarged view of a circled portion in Fig. 5;

Fig. 7 is a view similar to Fig. 6, illustrating a modified embodiment of the golf club head in accordance with the present invention;

Fig. 8 is an exploded perspective view of another modified embodiment of the golf club head in accordance with the present invention; and

Fig. 9 is a sectional view of the golf club head in Fig. 8 after processing.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Preferred embodiments of the present invention are now to be described hereinafter in detail, in which the same reference numerals are used in the preferred embodiments for the same parts as those in the prior art to avoid redundant description.

Fig. 3 is an exploded sectional view illustrating a golf club head in accordance with the present invention before processing. Fig. 4 is a sectional view of the golf club head in Fig. 3. Fig. 5 is a sectional view of the golf club head in accordance with the present invention after processing. Fig. 6 is an enlarged view of a circled portion in Fig. 5.

Referring to Figs. 3, the golf club head in accordance with the present invention includes a golf club head body 10, a striking plate 20, and a ring 30. The golf club head body 10 is made of a material having a Young's modulus greater than 3×10^7 psi, such as stainless steel, carbon steel, alloy steel, or Fe-Mn-Al alloy. The golf club head body 10 includes a recession 11 in a side thereof, the recession 11 having a shoulder 12 on an inner peripheral edge thereof and a flange 13 on an outer peripheral edge thereof.

The striking plate 20 is made of titanium alloy (such as 6Al-4V Ti alloy), stainless steel of, e.g., S20C, 8620, or SUS 304, or special steel (such as 4130 carbon steel). Thus, the material of the striking plate 20 has a Young's

modulus smaller than 3 x 10^7 psi; namely, the Young's modulus of the material of the striking plate 20 is smaller than that of the material of the golf club head body 10. Further, the material of the striking plate 20 has a coefficient of restitution (COR) greater than that of the golf club head body 10. The striking plate 20 further includes a stepped portion 21 on a periphery thereof. The striking plate 20 is inserted into the recession 11 of the golf club head body 10.

The ring 30 is preferably made of a material having a Young's modulus smaller than 3 x 10^7 psi, such as titanium having a Young's modulus of 1.72 x 10^7 psi, brass/bronze having a Young's modulus of 1.70 x 10^7 psi, aluminum having a Young's modulus of 1.0 x 10^7 psi, magnesium having a Young's modulus of 6 x 10^6 psi, or wood having a Young's modulus of 1.0 x 10^6 psi. The ring 30 is mounted to the shoulder 12 of the golf club head body 10. Preferably, the shoulder 12 of the golf club head body 10 delimits an annular groove 121 for securely receiving the ring 30.

In manufacture, the ring 30 is inserted into the annular groove 121 of the golf club head body 10. Preferably, a portion of the ring 30 slightly protrudes beyond the annular groove 121. Next, the striking plate 20 is inserted into the recession 11 of the golf club head body 10 and thus supported by the ring 30, as shown in Fig. 4. Then, a pressing block (not shown) is used to press the flange 13 and thus causes deformation of the flange 13. Thus, the flange 13 deforms and becomes a filling material 13' that engages with the

stepped portion 21. The ring 30 is also deformed during the pressing procedure, thereby completing the connection of the striking plate 20 to the golf club head body 10, as shown in Fig. 5.

After manufacture, a portion of a rear side of the striking plate 20 having a relatively smaller Young's modulus is supported by the ring 30 also having a relatively smaller Young's modulus. Thus, the contact area between the striking plate 20 and the shoulder 12 of the golf club head body 10 having a relatively greater Young's modulus is reduced. Thus, the amount of the striking stress of the striking plate 20 absorbed by the golf club head body 10 is reduced through the use of the ring 30. This assures high deformability of the striking plate 20 and reduces the deformation of the golf ball. The loss of the striking stress resulting from compression of the golf ball is reduced. The striking effect (or striking distance) of the golf club head is thus improved. Further, since the amount of the striking stress of the striking plate 20 absorbed by the golf club head body 10 is reduced, the golf club head body 10 generates small vibrations. The gripping comfort of the golf club is thus improved.

Further, as illustrated in Fig. 6, the annular groove 121 may include a plurality of notches 122 in each of two opposed annularly extending corner portions thereof. The ring 30 is deformed and fills the notches 122 during the pressing procedure. The amount of deformation of the ring 30 is equal to the overall volume of the notches 122. This assures high deformability of the

striking plate 20. Further, the striking plate 20 absorbs the vibrations generated during the striking motion, and the striking effect of the golf club is largely improved.

It is noted that the pressing procedure can be replaced by welding or snapping. The welding may include tungsten inert gas arc welding, brazing, laser welding, plasma-arc welding, or ion beam welding. The filling material 13' derived from the flange 13 is used as the welding material during the welding procedure.

Fig. 7 illustrates a modified embodiment of the golf club head in accordance with the present invention. In this embodiment, a gap 14 is defined between the striking plate 20 and the shoulder 12, and a filling layer 40 fills the gap 14. This further reduces the contact area between striking plate 20 and the shoulder 12 of the golf club head body 10. This assures high deformability of the striking plate 20 and improves the striking effect (or striking distance) of the golf club head. Further, the filling layer 40 that fills the gap 14 avoids generation of noise during striking of the golf club head body 10 by the striking plate 20 as a result of striking a golf ball. This assures the golf club product meets the quality control standard. Further, the filling layer 40 is formed by filling a photocuring resin into the gap 14 and then radiating the resin with a light source (not shown) for hardening the resin. Thus, the gap 14 may have an opening that is regular, flat, and good-looking without adversely affecting the striking effect. This further reduces the

connecting flaw between the golf club head body 10 and the striking plate 20, and the appearance of the golf club product is aesthetically pleasing.

The photocuring resin is preferably a light-sensitive type adhesive that hardens when radiated by visible lights or ultraviolet (UV) rays; namely a resin that hardens under radiation with visible lights or UV rays, such as the photocuring resin sold by Dymax® Inc. under the name of Dymax Ultra Fast™. After filling the photocuring resin into the gap 14, a light source is used to radiate the photocuring resin, causing a photochemical reaction of the photocuring resin. The light source radiates ultraviolet rays having a wavelength smaller than 390 nm or visible lights that are preferably blue lights or purple lights having a wavelength between 400 and 500 nm with a radiation intensity of 500 mw/cm^2. Thus, the photocuring resin hardens and thus forms the filling layer 40 within a predetermined time period (about 10-40 seconds).

Further, since the photocuring resin has a relatively high metal-bonding capability, relatively low viscosity (high flowability), and good capillary action before hardening, the photocuring resin may easily penetrate into and thus fills tiny slits between the golf club head body 10, the striking plate 20, and the ring 30 as well as the gap 14. Thus, an excellent bonding is created between the metal surface of the golf club head body 10 and the metal surface of the striking plate 20. The operational convenience would not be adversely affected by excessive viscosity of the photocuring resin. Further,

since the photocuring resin hardly includes volatile adhesive compositions such that voids generated as a result of a reduction in the volume of the photocuring resin after hardening would not occur. Thus, the photocuring resin provides an excellent slit/gap filling functions.

Fig. 8 is an exploded perspective view of another modified embodiment of the golf club head in accordance with the present invention. Fig. 9 is a sectional view of the golf club head in Fig. 8. In this embodiment, the ring 30 includes a base portion 32 and an annular protrusion 31 on an upper side of the base portion 32. The annular protrusion 31 is provided for enclosing the outer periphery of the striking plate 20. When mounting the striking plate 20 and the ring 30 into the recession 11 of the golf club head body 10, the striking plate 20 is located inside the annular protrusion 31 of the ring and supported by the base portion 32 of the ring 30. Thus, the striking plate 20 having a smaller Young's modulus is supported by the base portion 32 and the annular protrusion 31 of the ring 30 having a greater Young's modulus. Further, the shoulder 12 of the golf club head body 10 and the striking plate 20 have a gap 14 therebetween, which largely reduces the contact area between the striking plate 20 and the golf club head body 10 having a relatively greater Young's modulus is reduced. Thus, the amount of the striking stress of the striking plate 20 absorbed by the golf club head body 10 is reduced through the use of the ring 30. This assures high deformability of the striking plate 20 and reduces the deformation of the golf ball. The loss

of the striking stress resulting from compression of the golf ball is reduced, which improves the striking effect (or striking distance) of the golf club head.

While the principles of this invention have been disclosed in connection with specific embodiments, it should be understood by those skilled in the art that these descriptions are not intended to limit the scope of the invention, and that any modification and variation without departing the spirit of the invention is intended to be covered by the scope of this invention defined only by the appended claims.